IN THE SPECIFICATION:

Please amend the specification as follows:

Please substitute the paragraph beginning at page 1, line 15, and ending on page 2, line 3, with the following.

-- In production of semiconductor devices, an electron beam exposure technique receives a great deal of attention, as a promising candidate of lithography, capable of micro-pattern exposure at a line width of 0.1 μm or less. There are several electron beam exposure methods. An example is a variable rectangular beam method of drawing a pattern with one stroke. This method suffers from many problems as a mass-production exposure apparatus because of a low throughput. To attain a high throughput, there is proposed a pattern projection method of reducing and transferring a pattern formed on a stencil mask. This method is advantageous to a simple repetitive pattern, but disadvantageous to a random pattern such as a logic interconnection pattern in terms of the throughput, and a low productivity disables practical application. --

Please substitute the paragraph beginning at page 2, line 4, with the following.

-- To the contrary, a multi-beam system for drawing a pattern simultaneously with a plurality of electron beams without using any mask has been proposed and is very advantageous ~~to~~ for practical use because of the absence of physical mask formation and exchange. What is important in using ~~a~~ multi-electron beams is the number of electron lenses formed in an array used in this system. The number of electron lenses determines the number of beams, and is a main factor which determines the throughput. Downsizing the electron lenses while improving

the performance of them is one of the keys to improving the performance of the multi-beam exposure apparatus. --

Please substitute the paragraph beginning at page 2, line 17, with the following.

-- Electron lenses are classified into electromagnetic and electrostatic types. The electrostatic electron lens does not require any coil core or the like, is simpler in structure than the electromagnetic electron lens, and is more advantageous to downsizing. Principal prior ~~arts~~ art concerning downsizing of the electrostatic electron lens (electrostatic lens) will be described. --

Please substitute the paragraph beginning at page 3, line 15, with the following.

-- In the prior ~~arts~~ art, if many aperture electrodes are arrayed, and different lens actions are applied to electron beams, the trajectories and aberrations change under the influence of the surrounding electrostatic lens field, and so-called crosstalk occurs in which electron beams are difficult to operate independently. --

Please substitute the paragraph beginning at page 4, line 22, and ending on page 5, line 8, with the following.

-- The present invention has been made to overcome the conventional drawbacks, and has as its principal object to provide an improvement of the prior ~~arts~~ art. It is an object of the present invention to provide an electron optical system which realizes various conditions such as

downsizing, high precision, and high reliability at a high level. It is another object of the present invention to provide an electron optical system improved by reducing crosstalk unique to a multi-beam. It is still another object of the present invention to provide a high-precision exposure apparatus using the electron optical system, a high-productivity device manufacturing method, a semiconductor device production factory, and the like. --

Please substitute the paragraph beginning at page 9, line 20, and ending on page 10, line 23, with the following.

-- According to the seventh aspect of the present invention, there is provided a device manufacturing method comprising the steps of installing a plurality of semiconductor manufacturing apparatuses, including a charged-particle beam exposure apparatus, in a factory, and manufacturing a semiconductor device by using the plurality of semiconductor manufacturing apparatuses. In this aspect, the charged-particle beam exposure apparatus has a charged-particle source for emitting a charged-particle beam, a first electron optical system which has a plurality of electron lenses and forms a plurality of intermediate images of the charged-particle source by the plurality of electron lenses, and a second electron optical system for projecting on a substrate the plurality of intermediate images formed by the first electron optical system. The first electron optical system includes a plurality of electrodes which have apertures for transmitting the charged-particle beam and are arranged in one plane, and a shield interposed between the adjacent electrodes. According to a preferred mode of the present invention, the manufacturing method further comprises the steps of connecting the plurality of

semiconductor manufacturing apparatuses by a local area network, connecting the local area network to an external network of the factory, acquiring information about the charged-particle beam exposure apparatus from a database on the external network by using the local area network and the external network, and controlling the charged-particle beam exposure apparatus on the basis of the acquired information. --

Please substitute the paragraph beginning at page 23, line 13, and ending on page 24, line 10, with the following.

-- Fig. 9 shows multiple electron optical system arrays according to the third embodiment. In the third embodiment, electron optical system arrays 12 and 13 of Xθ (θ = 45°) and Xθ (θ = 135°) are added to the two electron optical system arrays 10 and 11 of Xθ (θ = 90°) and Xθ (θ = 0°) described in the second embodiment, and a total of four electron optical system arrays 10 to 13 are arranged along the optical axis. The lens of θ (θ = 45°) has a beam convergence effect in the direction of θ = 135°, while the lens of θ (θ = 135°) has a beam convergence effect in the direction of θ = 45°. The convergence effect acts from four rotation-symmetrical directions, which is the same as the action of an astigmatism correction lens used in a general electron beam apparatus. Hence, divergence of a beam represented by 12 in Fig. 8 is suppressed, and a highly converged electron beam can be obtained. Also, in the third embodiment, each electron optical system array can employ a plurality of middle electrodes, similar to the embodiment shown in Fig. 5, or a lens may be constituted by n (n >= 3) electrodes. The number of electron optical

system units is not limited to four, arbitrary N stages (N >= 1) can be adopted, and the number of stages can be determined in accordance with the allowable value of correction aberration. --

Please substitute the paragraph beginning at page 26, line 12, and ending on page 27, line 21, with the following.

-- Figs. 12A and 12B are views for explaining details of the correction electron optical system 503. The correction electron optical system 503 comprises an aperture array AA, blanker array BA, element electron optical system array LAU, and stopper array SA along the optical axis. Fig. 12A is a view of the correction electron optical system 503 when viewed from the electron gun 501, and Fig. 12B is a sectional view taken along the line A - A′ in Fig. 12A. As shown in Fig. 12A, the aperture array AA has an array (8×8) of apertures regularly formed in a substrate, and splits an incident electron beam into a plurality of (64) electron beams. The blanker array BA is constituted by forming on one substrate <u>a</u> plurality of deflectors for individually deflecting a plurality of electron beams split by the aperture array AA. The element electron optical system array unit LAU is formed from first and second electron optical system arrays LA1 and LA2 as electron lens arrays each prepared by two-dimensionally arraying a plurality of electron ~~lens~~ <u>lenses</u> on the same plane. The electron optical system arrays LA1 and LA2 have a structure as an application of the single or multiple electron optical system arrays described in the above embodiments to an 8×8 array. The first and second electron optical system arrays LA1 and LA2 are fabricated by the above-mentioned method. The element electron optical system array unit LAU constitutes one element electron optical system EL by the

electron lenses of the first and second electron optical system arrays LA1 and LA2 that use the common X-Y coordinate system. The stopper array SA has a plurality of apertures formed in a substrate, similar to the aperture array AA. Only a beam deflected by the blanker array BA is shielded by the stopper array SA, and ON/OFF operation of an incident beam to the wafer 505 is switched for each beam under the control of the blanker array. --

Please substitute the paragraph beginning at page 28, line 2, with the following.

-- <Example of A Semiconductor Production System> --

Please substitute the paragraph beginning at page 28, line 3, with the following.

-- A production system for a semiconductor device (e.g., a semiconductor chip such as an IC or LSI, a liquid crystal panel, a CCD, a thin-film magnetic head, a micromachine, or the like) using the exposure apparatus will be exemplified. A trouble remedy or periodic maintenance of a manufacturing apparatus installed in a semiconductor manufacturing factory, or maintenance service such as software distribution is performed by using a computer network outside the manufacturing factory. --

Please substitute the paragraph beginning at page 28, line 13, and ending on page 29, line 9, with the following.

-- Fig. 13 shows the overall system cut out at a given angle. In Fig. 13, reference numeral 1010 denotes a business office of a vendor (apparatus supply manufacturer) which provides a

semiconductor device manufacturing apparatus. Assumed examples of the manufacturing apparatus are semiconductor manufacturing apparatuses for performing various processes used in a semiconductor manufacturing factory, such as pre-process apparatuses (e.g., a lithography apparatus including an exposure apparatus, a resist processing apparatus, and an etching apparatus, an annealing apparatus, a film formation apparatus, a planarization apparatus, and the like) and post-process apparatuses (e.g., an assembly apparatus, an inspection apparatus, and the like). The business office 1010 comprises a host management system 1080 for providing a maintenance database for the manufacturing apparatus, a plurality of operation terminal computers 1100, and a LAN (Local Area Network) 1090, which connects the host management system 1080 and computers 1100 to construct an intranet. The host management system 1080 has a gateway for connecting the LAN 1090 to Internet 1050 as an external network of the business office, and a security function for limiting external ~~accesses~~ access. --

Please substitute the paragraph beginning at page 29, line 10, and ending on page 30, line 3, with the following.

-- Reference numerals 1020 to 1040 denote manufacturing factories of the semiconductor manufacturer as users of manufacturing apparatuses. The manufacturing factories 1020 to 1040 may belong to different manufacturers or the same manufacturer (e.g., a pre-process factory, a post-process factory, and the like). Each of the factories 1020 to 1040 is equipped with a plurality of manufacturing apparatuses 1060, a LAN (Local Area Network) 1110, which connects these apparatuses 1060 to construct an intranet, and a host management system 1070 serving as a

monitoring apparatus for monitoring the operation status of each manufacturing apparatus 1060. The host management system 1070 in each of the factories 1020 to 1040 has a gateway for connecting the LAN 1110 in the factory to the Internet 1050 as an external network of the factory. Each factory can access the host management system 1080 of the vendor 1010 from the LAN 1110 via the Internet 1050. Typically, the security function of the host management system 1080 authorizes access of only a limited user to the host management system 1080. --

Please substitute the paragraph beginning at page 30, line 4, with the following.

-- In this system, the factory notifies the ~~vender~~ vendor via the Internet 1050 of status information (e.g., the symptom of a manufacturing apparatus in trouble) representing the operation status of each manufacturing apparatus 1060. The ~~vender~~ vendor transmits, to the factory, response information (e.g., information designating a remedy against the trouble, or remedy software or data) corresponding to the notification, or maintenance information such as the latest software or help information. Data communication between the factories 1020 to 1040 and the ~~vender~~ vendor 1010 and data communication via the LAN 1110 in each factory typically adopt a communication protocol (TCP/IP) generally used in the Internet. Instead of using the Internet as an external network of the factory, a dedicated-line network (e.g., an ISDN) having high security, which inhibits access of a third party, can be adopted. It is also possible that the user constructs a database in addition to one provided by the vendor and sets the database on an external network and that the host management system authorizes access to the database from a plurality of user factories. --

Please substitute the paragraph beginning at page 30, line 26, and ending on page 32, line 19, with the following.

-- Fig. 14 is a view showing the concept of the overall system of this embodiment that is cut out at a different angle from Fig. 13. In the above example, a plurality of user factories having manufacturing apparatuses and the management system of the manufacturing apparatus vendor are connected via an external network, and production management of each factory or information of at least one manufacturing apparatus is communicated via the external network. In the example of Fig. 14, a factory having a plurality of manufacturing apparatuses of a plurality of vendors, and the management systems of the vendors of these manufacturing apparatuses are connected via the external network of the factory, and maintenance information of each manufacturing apparatus is communicated. In Fig. 14, reference numeral 2010 denotes a manufacturing factory of a manufacturing apparatus user (semiconductor device manufacturer) where manufacturing apparatuses for <u>performing</u> various processes, e.g., an exposure apparatus 2020, <u>a</u> resist processing apparatus 2030, and <u>a</u> film formation apparatus 2040 are installed in the manufacturing line of the factory. Fig. 14 shows only one manufacturing factory 2010, but a plurality of factories are networked in practice. The respective apparatuses in the factory are connected to a LAN 2060 to construct an intranet, and a host management system 2050 manages the operation of the manufacturing line. The business offices of vendors (apparatus supply manufacturers) such as an exposure apparatus manufacturer 2100, <u>a</u> resist processing apparatus manufacturer 2200, and <u>a</u> film formation apparatus manufacturer 2300 comprise host management systems 2110, 2210 and 2310 for executing remote maintenance for the supplied

apparatuses. Each host management system has a maintenance database and a gateway for an external network, as described above. The host management system 2050 for managing the apparatuses in the manufacturing factory of the user, and the management systems 2110, 2210, and 2310 of the vendors of the respective apparatuses are connected via the Internet or dedicated-line network serving as an external network 2000. If a trouble occurs in any one of a series of manufacturing apparatuses along the manufacturing line in this system, the operation of the manufacturing line stops. This trouble can be quickly solved by remote maintenance from the vendor of the apparatus in trouble via the external network 2000. This can minimize ~~stop~~ stoppage of the manufacturing line. --

Please substitute the paragraph beginning at page 33, line 21, and ending on page 34, line 23, with the following.

-- A semiconductor device manufacturing process using the above-described production system will be explained. Fig. 16 shows the flow of the whole manufacturing process of the semiconductor device. In step 1 (circuit design), a semiconductor device circuit is designed. In step 2 (creation of exposure control data), exposure control data of the exposure apparatus is created based on the designed circuit pattern. In step 3 (wafer manufacture), a wafer is manufactured using a material such as silicon. In step 4 (wafer process), called a pre-process, an actual circuit is formed on the wafer by lithography using a prepared mask and the wafer. Step 5 (assembly), called a post-process, is the step of forming a semiconductor chip by using the wafer manufactured in step 4, and includes an assembly process (dicing and bonding) and a packaging

process (chip encapsulation). In step 6 (inspection), inspections such as the operation confirmation test and a durability test of the semiconductor device manufactured in step 5 are conducted. After these steps, the semiconductor device is completed and shipped (step 7). For example, the pre-process and post-process may be performed in separate dedicated factories. In this case, maintenance is done for each of the factories by the above-described remote maintenance system. Information for production management and apparatus maintenance is communicated between the pre-process factory and the post-process factory via the Internet or dedicated-line network. --

Please substitute the paragraph beginning at page 34, line 24, and ending on page 35, line 19, with the following.

-- Fig. 17 shows the detailed flow of the wafer process. In step 11 (oxidation), the wafer surface is oxidized. In step 12 (CVD), an insulating film is formed on the wafer surface. In step 13 (electrode formation), an electrode is formed on the wafer by vapor deposition. In step 14 (ion implantation), ions are implanted in the wafer. In step 15 (resist processing), a photosensitive agent is applied to the wafer. In step 16 (exposure), the above-mentioned exposure apparatus draws (exposes) a circuit pattern on the wafer. In step 17 (developing), the exposed wafer is developed. In step 18 (etching), the resist is etched except for the developed resist image. In step 19 (resist removal), an unnecessary resist after etching is removed. These steps are repeated to form multiple circuit patterns on the wafer. A manufacturing apparatus used in each step undergoes maintenance by the remote maintenance system, which prevents a

trouble in advance. Even if ~~a~~ trouble occurs, the manufacturing apparatus can be quickly recovered. The productivity of the semiconductor device can be increased in comparison with the prior art. --